



Northern Rhodesia

Department of Agriculture

ANNUAL REPORT
for the year
1946

1947

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Department of Agriculture

ANNUAL REPORT FOR THE YEAR 1946

AGRICULTURE IN THE TERRITORY

1. Despite rising costs of production, 1946 was a prosperous year for the agricultural industry. There were many new settlers, most of whom intend to make tobacco growing their major activity.

Maize : Railway Belt.

2. The season was not as favourable as its predecessor but increased acreage maintained European maize production near the record level achieved in 1945. Approximately 350,000 bags were produced, of which 268,000 bags were delivered to the Maize Control Board.

3. The less favourable season naturally reacted more sharply on the native crop and the decline of 30,000 bags from the figure of 202,000 bags purchased in 1945 does not truly reflect the position, as the 1946 purchases included considerable quantities of old grain belonging to the previous year's harvest.

4. The following table shows maize production in the railway belt, exclusive of a considerable volume of inter-village trade, during the past six years. The figures refer to calendar years and do not tally exactly with those for maize handled by the Maize Control Board in "pool-years".

MAIZE PRODUCTION FOR SALE.

(Thousands of bags.)

<i>Year of Harvest</i>	<i>European</i>	<i>Native</i>	<i>Total</i>
1941	120	38	158
1942	146	51	197
1943	144	60	204
1944	212	115	327
1945	273	202	475
1946	268	172	440

In addition to the 440,000 bags received from the railway belt, 11,000 bags were sent in from distant areas. The Civil Supplies Department also purchased 5,000 bags of locally grown kaffir-corn.

5. Total consumption of maize, exclusive of that retained on farms, amounted to 536,000 bags in the calendar year. The shortfall was covered by the carry-over from the previous year.

Wheat.

6. Wheat production was well maintained at about 27,000 bags, of which 24,750 bags were sold.

Potatoes, Beans and Nuts.

7. The Civil Supplies Department handled the following locally grown produce :

Potatoes	...	...	...	14,500 bags.
Beans	...	...	...	8,200 bags.
Ground-nuts	...	...	...	5,100 bags.

Ground-nut production, though still very small, showed considerable increase largely through development of the crop in Petauke District.

Tobacco : Eastern Area.

8. The flue-cured Virginia crop amounted to 2,823,000 lb. of leaf, representing an average yield of nearly 500 lb. per acre. On the whole the quality was rather poor, but the crop sold

well. Non-quota tobacco averaged 24.57 pence per lb. and quota tobacco 36.68 pence. The overall average was 26.46 pence per lb. In addition, the Eastern Area produced 28,000 lb. of Turkish leaf and 43,000 lb. of Western sun- and air-cured.

Tobacco : Western Area.

9. Low rainfall in the latter part of the season reduced yield and quality of Virginia flue-cured tobacco and the total crop was only 307,000 lb., with an average yield of just over 500 lb. per acre. The bulk of the crop was sold over the Salisbury Auction Floors and averaged over 29 pence per lb. No quota tobacco was sold from the Western Area in 1946.

10. Turkish tobacco production continued its rapid expansion in the Western Area, and by the end of the year nearly one million pounds had been consigned to Southern Rhodesia for manipulation and grading.

Beeswax.

11. Exports of beeswax amounted to approximately 1,200 cwt., a fall of over 500 cwt. from the peak production achieved in 1945, but still a very satisfactory figure for an industry confined largely to the remote Balovale and Mwinilunga Districts.

The Red Locust (*Nomadacris septemfasciata*).

12. Thanks to the successful campaigns in the Rukwa and Mweru outbreak-centres, carried out by the International Red Locust Control Organisation, the Territory was free from locusts throughout the year.

The Ground-nut Project.

13. During the year the United Kingdom Ground-nut Mission visited the Territory and recommended the early establishment of 17 "Units" of 30,000 acres each, half of which will be cropped with ground-nuts annually. Not only will the effects on the Territorial economy of this vast undertaking be profound, but a valuable lead toward completely mechanised production will be given to individual farmers who are already seeking a solution of the ever-increasing problem of farm labour.

THE WORK OF THE DEPARTMENT

14. Although the actual establishment was increased by the appointment of one Agricultural Officer and three Agricultural Supervisors, the effective strength was at the lowest ebb for many years as many of the more experienced members of the staff were absent on long-overdue leave. In the circumstances little or no new ground could be broken and existing programmes could only be maintained with difficulty. The important Kanchomba station in the Southern Province was without European staff for several months. Such a state of affairs was inevitable during the immediate post-war period, and it is better that it should have arisen and been endured then than that it should arise at the beginning of the "Development Period". At the end of the year the European establishment was :

<i>Approved</i>	<i>Actual</i>	<i>On duty</i>
1	1	1 Director.
1	1	— Assistant Director.
1	1	— Ecologist.
3	3	1 Senior Agricultural Officers.
10	9	7 Agricultural Officers.
2	2	2 Senior Agricultural Supervisors.
10	6	5 Agricultural Supervisors.
4	4	4 Clerks (two learners, two part-time).

15. Forestry was administered as a sub-department throughout the year but was granted long-overdue and well-merited independence at the beginning of 1947. The Forestry Report for 1946 will be published separately by the Acting Conservator. The long association of Forestry with Agriculture will ensure active co-operation on all conjoint problems in the future. I would take this opportunity, confident that the wish will be fulfilled, of wishing the new department every success.

16. The Ecologist's soil-vegetation map (1 : 1,000,000) remained at the lithographers throughout the year but a proof was received and corrected. It will be published with the brief explanatory memoir during 1947.

European Agriculture.

17. In addition to part-time advisory work by all members of the staff stationed on the line of rail, the full-time services of the Senior Agricultural Officer, Lusaka, were made available to European farmers. He was almost continually on tour and paid 462 visits to a total of 180 farms between Magoye and Broken Hill during the course of the year. Under his guidance 12,000 acres of dry arable land have been protected from erosion during the last few years. In addition, a considerable new acreage has been brought under well designed irrigation schemes. Assistance was given to new settlers in the layout of their farms and in the planning of their agricultural operations.

Lusaka Agricultural Station.

18. This station was opened in 1944 mainly for experimental work on irrigated wheat, but dry lands are now being developed and it is intended, in co-operation with the Veterinary Department, to add dairy farming to the activities. When taken over, the irrigated lands were in a deplorable, eroded and exhausted state. The irrigation system was promptly remodelled to eliminate erosion and the slow process of building up the soil has begun. In 1944, the first year of operation, the wheat yield was less than three bags per acre. In the following year it was raised to 6.5 bags, but in the year under review this yield was no more than maintained. Failure to increase the average yield in 1946 is largely due to two causes, both inseparable from the nature of the work at the station. The growing of a number of varieties, each with a different maturity period, exposes a long succession of ripening wheat to bird damage. The station, indeed, appears to attract all the birds in the neighbourhood and, in spite of such protective measures as could be taken, the damage was particularly severe in 1946. The other factor which must inevitably reduce yields is the necessity for persisting with a number of low yielding varieties until it is proved beyond all doubt that they are unsatisfactory under local conditions. Thus, for example, the yields of fourteen varieties grown in bulk varied from nine to two bags per acre.

19. Until a Plant Breeder has been appointed no serious breeding or selection work can be attempted. The programme at present consists of introducing selected pure lines of wheat annually and during the following three years of studying their behaviour under local conditions, eliminating the least satisfactory and bulking-up and distributing those of the greatest promise. Obviously such a programme is dependent on the good offices of other territories and the kind co-operation of the Departments of Agriculture of Southern Rhodesia and Kenya is gratefully acknowledged.

20. Differing degrees of bird damage, due as much to position of the plots as to differences in bird-resistance, largely vitiated the results of variety trials. Of the newly imported pure lines 261.R.7.C.1.B. (Kenya), *Matopo* (S.R.), 294.M.7.C.6.C. (Kenya), *E.M.S. Sabanero* (S.R.), *Pusa 4* (S.R.), and *Australian 26.A.14* (S.R.) were outstanding in performance, though *Pusa 4* developed stem rust badly and 261.R.7.C.1.B. and *Matopo* slightly. In the trials of first-from-imported varieties *Matopo*, *Punjab 8A* and *Sabanero* gave the highest yields. *Kruger Beardless*, *Kruger Bearded*, 294.M.7.C.6.C. and *Matopo* all yielded over eight bags per acre in the bulk plots.

21. From three years of observation at the station and on farms in the district the following conclusion can be drawn :

- (a) Generally, varieties susceptible to stem rust are the highest yielders except when the incidence of rust is severe. The most popular variety locally, *Punjab 8A*, and the promising introduction *Matopo* are outstanding examples of this general rule.
- (b) For bad rust areas the two *Krugers* are worthy of trial on soils in good heart but they are not tolerant of poor soils, and should be sown at not less than 66 lb. per acre. 294.M.7.C.6.C., if it maintains its early promise under local conditions, may provide a partial solution of the rust problem.
- (c) Much of the damage caused by rust and " plant lice " and of the loss of crops due to " blindness " could be reduced if wheat lands were given more generous manurial treatment.
- (d) The best yielding wheats are generally those with the worst baking qualities. This is notably so with *Punjab 8A*, *Matopo* and 294.M.7.C.6.C. From the baker's point of view the two *Krugers* are our best varieties. While wheat is purchased at a flat rate regardless of quality, farmers will naturally be interested only in yield. We cannot, however, become self-supporting in wheat while the most popular varieties are deficient in baking qualities, as the bulk of our crop is only fit for blending with high-quality imported wheats. The solution would appear to be

the payment of a premium on baking quality but, at the moment, it appears that the premium would have to be a very high one to compensate farmers for loss in yield.

Msekera Tobacco Station.

22. Msekera Tobacco Station near Fort Jameson was opened in 1931. Its soils consist of fertile red loams which, at the time the site was selected, were representative of the majority of the local tobacco estates, but which have since declined in popularity in favour of more orthodox light sands. In the absence of a large staff and considerable buildings and equipment it is virtually impossible to conduct critical experiments with a crop like tobacco, and the station has been used more as a demonstration and seed-producing centre. Nevertheless many valuable lessons have been learned from it.

23. The standard rotation which has been adopted is tobacco : tobacco : sunnhemp : maize, the tobacco plots receiving light annual dressings of 150 to 200 lb. of complete tobacco fertilizer. On these rich soils this rotation seems remarkably successful in maintaining fertility and there is no evidence that the quality of the tobacco has suffered from continuous cropping. This was strikingly demonstrated in the year under review. Ten acres of old land which had been cropped continuously for periods ranging from ten to sixteen years, yielded at the rate of 1,108 lb. cured leaf per acre (one acre of *Willow Leaf* gave 1,483 lb.); while eleven and one-half acres of comparable new land yielded an average of 540 lb. Moreover, there was no appreciable difference in the percentage of "brights" obtained from the old and new land. Too much significance must not be attached to this result but it does give rise to the comforting thought that on these fertile soils, at least, continuous rotational cropping, with half the acreage under tobacco, is practicable with proper management.

24. The total crop from the station was $8\frac{1}{2}$ tons and it was sold over the auction floor at an average price of 34.8 pence per lb., the district average price for non-quota tobacco being 24.57 pence per lb. and the overall price 26.46 pence.

25. Through the courtesy of the Trelawney Tobacco Research Station in Southern Rhodesia, selected seed of *Bonanza*, *Gold Dollar*, *Jamaica Wrapper*, *Yellow Mammoth*, *White Stem Orinoco* and *Willow Leaf* was obtained and sown. The resulting seed was offered for sale to planters and 47 lb. were sold. In addition, 155 lb. of the planters' own seed were blown and disinfected.

26. The most popular varieties in the district are now *Bonanza*, *White Stem Orinoco* and *Willow Leaf*, in that order. In the station trials of the six introduced varieties, *Willow Leaf* and *White Stem Orinoco* made the best showing, with *Yellow Mammoth* a good third. *Bonanza* gave the highest percentage of "brights" on the new and *White Stem Orinoco* on the old lands.

Native Agriculture.

27. Departmental work on native agriculture is based at present on the following agricultural stations :

SOUTHERN PROVINCE	...	Kanchomba. Monze. Magoye.
EASTERN PROVINCE	...	Katete. Kalichero. Petauke.
WESTERN PROVINCE	...	Kambowa.
NORTHERN PROVINCE	...	Lunzuwa.

Reclamation and Preservation of Native Areas.

(a) SOUTHERN PROVINCE.

28. Work in the Southern Province has been confined to some fourteen of the Tonga Plateau Chieftaincies which form the core of the native maize growing area and constitute, from a purely economic point of view, the most important native area of the Territory. At the beginning of the war this area, some 1,500 square miles in extent, was in process of rapid degeneration owing to over-population (measured by the land requirements of traditional agriculture), use of the plough and over-stocking. The objects of the programme carried out

over the last six years have been to check accelerated erosion on cultivated land and to introduce a system of permanent agriculture, previously worked out, based on the use of cattle manure and rotation of maize with legumes.

29. The method of erosion control adopted has been construction of contour ridges on the steeper slopes and lands most affected by erosion, and the use of contour grass strips elsewhere.

30. Contour ridges are put in at a maximum vertical interval of 7 feet and a maximum horizontal distance of 75 yards. This spacing is, of course, by no means ideal; it represents a compromise with circumstances and the wishes of the cultivators and is intended to be used in conjunction with contour ploughing and cultivating which become virtually obligatory once the ridges have been constructed. The standard dimensions of the ridges are—base 8 feet 6 inches; height (consolidated) 18 inches. A grass strip 1 yard in width is maintained along the upper lip of the trench and is essential to prevent too rapid silting of the drains. The grade of ridge and trench is generally constant and ranges from 1 in 400 to 1 in 600, but variable grades are sometimes used. Construction of contour ridges is entirely by hand labour. In the local circumstances this has so far been cheaper than the use of machinery which has, in any case, been unobtainable. The only implements used are mattocks and shovels.

31. Grass strips, allowed to cover over naturally, are used on the more level land (slopes not exceeding 1 in 80) which is not gullied or severely eroded. Such strips are generally at a horizontal distance of approximately 50 yards and they are 5 yards in width. They are demarcated by rough wooden posts 10 yards apart, at the upper and lower edges of each strip, using posts of the termite-resistant and durable wood Mubanga (*Afrormosia angolensis*).

32. The ridges and grass strips are laid out in conformity with a general land-use plan which includes the demarcation of grazing land, strips for water disposal and other areas excluded from cultivation.

33. So far the main emphasis of the programme has of necessity been on the checking of erosion, and general improvement of agricultural method has taken second place. Progress in the latter direction has been slow (though by no means negligible) except for a startling increase in the use of cattle manure, largely a result of intensive propaganda and demonstration.

34. It may fairly be said that the work of the last six years has saved the situation, checked the process of degeneration and enabled the area to continue to produce a substantial marketable surplus of maize during the years when it was most urgently required. Very much more remains to be done if the fertility of the soil is to be built up to meet the needs of an increasing population and to improve the standard of living of the great bulk of the people beyond its present meagre level. The time has almost come when the emphasis may safely be changed to progress rather than reclamation, but the path to progress, on the revolutionary scale required by the situation, is beset by a bewildering complex of problems, few of which are essentially agricultural.

35. During 1946 the programme of reclamation was continued on the lines laid down in previous years but the work was much handicapped by staff shortage, leave movements, sickness and transport difficulties. For a considerable part of the year the effective European field staff was reduced to two supervisors. The contour ridging work was much reduced but a very considerable area was laid out in grass strips, a method which requires much less European supervision.

36. In the table below the soil protection works completed in 1946 are shown, together with the totals for the six preceding years of the programme.

		<i>Acres of cultivated land protected</i>	<i>Miles of contour ridge constructed</i>	<i>Miles of grass strips demarcated</i>
1940-45 ...	...	49,537	1,137	199
1946 ...	...	7,642	66	144
		57,179	1,203	343

37. As in the past the cost of the reclamation work (exclusive of European supervision) was paid from the accumulated funds of the Native Maize Pool, and so, indirectly, by the cultivators who benefited. The cost of the contour ridging work averaged 2.1 pence per yard of

completed ridge. Demarcation of grass strips costs on the average about 40s. a mile, varying with the distance over which poles have to be carried.

38. Other work carried out during the year included the demarcation of additional grazing areas, upkeep and extension of the road systems, construction of a considerable mileage of road drain, most of which protected cultivated land, and the building of a number of small earth dams in the Kanchomba neighbourhood.

39. Nine dams averaging 90 yards in length and 10 feet in depth were completed at an average cost of £45 each. The purpose of the dams is to reduce erosion caused by concentration of cattle about watering points, to retard donga formation by cushioning run-off and to protect the headwaters of streams.

40. The demonstration gardens supervised by the department were again outstanding, but general improvement in agricultural methods continues to be slow. In most areas all the available kraal manure is now used, but, in spite of demonstration and precept, there is as yet no move to increase the supply by placing crop refuse and litter in the kraals. High prices for maize discouraged the planting of legumes, but in spite of this there was some increase in the acreage under cowpeas.

(b) EASTERN PROVINCE.

41. Large-scale movements of population in the Fort Jameson and Petauke Districts, necessitated by extreme congestion within the reserves, continue slowly. Movement was started in 1942, after a year of preliminary survey and preparation. By the end of 1943 the limits imposed by natural water supplies and the rate at which wells and dams could be constructed had been reached, and the rate of movement was of necessity slowed down.

42. In 1946 resettlement was again confined to Petauke District, where twenty-six villages with a population of 3,500 were moved into a controlled area and settled on the "parish" system described in the previous annual report.

43. The total of villages moved since the beginning of the scheme is now 318, with a population of about 35,000, and, in addition, a large extent mainly of escarpment and lower valley country has been opened to uncontrolled or partially controlled settlement. Very considerable areas remain unsettled, but these have been included in the programme of the Water Development Department for 1947, and if this programme is successful it may be possible to complete much of the resettlement work in the following year.

44. Since the slowing down of the rate of settlement it has been possible to give more attention to land protection, erosion control and experimental work. All cultivated land in the resettlement areas is protected either by contour grass strips or contour ridges at 2 feet 6 inches vertical interval. The contour ridges are made by the people themselves; they are built up to a base width of not less than 6 feet and a height of not less than 6 inches in the first year, and are increased each year by at least 1 foot in base width and 6 inches in height until the ridge is big enough not to break or to allow water to spill over. The making of such ridges entails a considerable amount of extra work for new villages; the amount of work involved can be gauged by the fact that twenty villages moved in 1946 constructed 62 miles of ridge during the two months prior to planting which was available for the work. In addition to ridging, a system of ridge cultivation, described in previous reports, is being introduced.

45. Hitherto the adoption of these methods has been a condition of occupation of new land, accepted verbally and voluntarily by the people, but in 1946 the Native Authorities of the Fort Jameson District passed a number of orders making these conservation measures compulsory not only in all of the new areas but in certain parts of the old Reserves. The new orders provide also for the recording of population movements, reporting of offences against agricultural rules, preparation and cultivation of gardens, and control of the use of the plough.

46. Apart from pioneer work and the Native Authority Orders mentioned in the last paragraph, the conservation and development problems of the old Reserves have not yet been tackled. It is intended to concentrate on these problems as soon as the new areas can be safely left with a minimum of supervision.

(c) WESTERN PROVINCE.

47. The most immediate problem of the Western Province was that posed by the concentration of population about the southern and eastern margins of the Copperbelt. This has to a large extent been solved temporarily by transfer of villages from the congested areas

to unoccupied Native Trust Land, and their resettlement in demarcated "village blocks" under some degree of agricultural control.

48. Resettlement started in 1943, and by the end of 1945 the major work of survey, demarcation, road making, establishment of watering points and game control had been completed, and 120 villages had been settled in the new areas.

49. It was found, however, that the original rapid census had yielded an over-estimate of the populations of the villages which were moved, and it was therefore decided to permit additional movement to an extent which would bring the mean population density of the resettlement area up to its carrying capacity as calculated on the basis of traditional Lamba agriculture; which is approximately twenty-two persons per square mile. This movement was deferred for a year in order to obtain more complete and accurate information on the population question. In 1946 only eleven villages (included in the original scheme) were moved, bringing the total of villages moved to 131, occupying about 550 square miles of land. An area of some 40 square miles remains unoccupied because no villages have so far volunteered to move into it, the main objection being its distance from the Copperbelt. There remains, too, the transfer of Nkana's people from within the mining area, a task which cannot be carried out until an accurate village census and survey has been completed by the Administration.

50. The scheme goes far beyond mere resettlement and provides for protection of the land, improvement of agriculture, and general development both in the new areas and the old Reserves. The proximity of the Copperbelt markets provides almost unique opportunities for such development, opportunities of which the people have so far made singularly little use.

51. Gardens within the new areas are demarcated with contour strips 5 yards wide at a vertical interval of 2 feet, and these strips are converted into two or three parallel ridges on which "relish" crops are grown. The method is, in effect, a form of strip cropping of the main cereal (kaffir-corn) with ridge cultivation of subsidiary crops, an adaptation of the former practice of ridging only in separate subsidiary gardens.

52. Headwaters of streams, springs, the margins of water-courses and steep slopes are protected and excluded from cultivation both in the resettlement area and the adjoining Reserves. Native Authority Forest Reserves have been demarcated and gazetted. Early burning is practised and in 1946 the whole of the country between the border of the Belgian Congo and the Kafue river was early burned.

53. Efforts are being made to increase the acreage and variety of food crops, and to induce the people to utilise the considerable area of land which is perennially moist or fairly easily irrigable, for production of rice, wheat and vegetables. Seed and other planting material has been distributed and seed farms have been established to provide for increasing requirements. In addition to fulfilling this need the seed farms are used as centres of experiment and demonstration.

54. In 1946 four simple irrigation schemes were laid out for villages which undertook to make use of them, and assistance was given with the design and construction of a number of small dams for irrigation and conservation. Fruit tree nurseries were maintained and increased in number throughout the district and, in spite of the usual lack of care and a severe frost in the late winter, the survival rate of seedlings distributed to the villages was satisfactorily high. In addition to fruit tree seedlings, considerable quantities of seed of beans, ground-nuts, pigeon pea, cowpea and European vegetables were distributed on a replacement basis or sold.

55. As a source of income the main emphasis for the time being is on the production of fresh vegetables for the local market. In co-operation with the Administration a start was made with a weekly buying service. By the end of the year a regular lorry service was being run through the resettlement area, purchasing vegetables and other foodstuffs at fixed buying points. The produce was marketed in Ndola. Should this pioneer service prove successful it is proposed to extend it to a much larger area of the Province.

56. The minor work of the year included preliminary vegetation-soil surveys in the area west of the Kafue, upkeep of the roads, and a considerable building programme. In addition to the purely departmental programme, a new court and houses for the senior Lamba Chief and his staff were built at the request of the Administration.

57. The bulk of the land on the Agricultural Station at Kambowa continued to be used for production of vegetables to supply the War Evacuees' Camp at Bwana Mkubwa.

(d) NORTHERN PROVINCE.

58. For the last eight years the main work in the Northern Province has centred on the *Chitemene* Control Scheme. Finger millet (*Eleusine coracana*) is the staple crop of the plateau regions of the province. The crop is normally grown under the *chitemene* system, whereby loppings from 6 to 10 acres of trees are piled on about 1 acre of land and burned, finger millet seed being broadcast on the ashes. The method, though wasteful of otherwise useless woodland, is extremely reliable and the yield of grain from wretchedly poor soils probably averages about 1,400 lb. per acre of burnt land. This compares favourably with average maize yields on very much better soils in Central and Southern Africa. The system has many other advantages, at least from the point of view of the people who practise it. Its great disadvantage is that concentrations of population are impracticable and that rapid deterioration takes place once the population-land balance is upset. The rapidity of this deterioration became evident within a few years of the creation of Native Reserves in the Abercorn District. In 1938, land adjoining these cut-out Reserves was taken over from the British South Africa Company and, with the offer of the bait of more woodland, little difficulty was experienced in securing reasonably active co-operation from the Native Authorities in launching the control scheme in this particular area. Elsewhere, where there is still adequate woodland and where degeneration has not reached an advanced stage, *chitemene* control has so far had little appeal; it was not expected that it would.

59. The essence of the scheme was the spreading of villages as evenly as circumstances would permit over the old Reserves and the new areas, so that each could be allotted a demarcated "village area" sufficient, with increased care of regeneration woodland, to provide for their *chitemene* gardens in perpetuity. Each area was sufficient to allow of subdivision into fifteen annual cutting blocks, and rotational lopping was enforced. Regenerating blocks were protected from the devastating effects of late fires by being deliberately singed as soon after the rains as the state of grass and undergrowth permitted (early burning). At the same time efforts were made to encourage the development of "dug" gardens, cultivated in the ordinary way with hoes, in the hope that gradual extension of these would provide for natural increase of population and that the people would, in time, be weaned away from a system which is only practicable on a permanent basis while the population density remains at about seven per square mile. The area under the control scheme now exceeds 3,000 square miles and includes 238 villages with a total population of about 22,000.

60. During 1946 the staff position was such that little more than routine work could be carried out. This included general supervision of the controlled area, demarcation of annual cutting blocks, early burning over the whole area within the scheme, control of erosion in "dug gardens", supervision of Native Authority seed farms, continuation of crop selection work and other normal departmental activities.

61. On burnt gardens cultivated under *chitemene* methods soil erosion is not a factor of importance, but it is a serious matter in the subsidiary village gardens. Within the controlled area simple measures have been taken to check erosion on these subsidiary gardens. In 1945 contour lines were marked out in all village gardens, and in 1946 simple bunds were dug by the garden owners. Seeds of pigeon pea were distributed for planting on the bunds and Napier fodder is being bulked on the seed farms for the same purpose. The response of the people to these measures has so far been good.

62. Outside the controlled area little can be done until the agricultural staff has been considerably strengthened. Improved methods of agriculture and "early burning" propaganda continue to be carried out through schools and by means of Agricultural Kapasus employed by Native Authorities.

63. A preliminary reconnaissance survey of Mambwe Reserve 4 was carried out during the year. This area of less than 200 square miles maintains a population of about 7,000 people and as many cattle. The stronger soils, transitional between Plateau and Lake Basin types and of excellent texture, are standing up remarkably well to the repeated recultivation to which they are subjected, but the plateau soils and poorer varieties of the transitional types are deteriorating under cultivation. Sheet erosion and incipient gullying are increasing.

64. Gardens for the cultivation of food crops by African residents of the townships at Kasama, Abercorn and Mpulungu were marked out, but so far these are not in much demand, mainly because of the rental which is charged for their use. The same factor may have acted as a deterrent in the case of the small-holdings for Africans at Lunzuwa, as no further holdings were taken up within the settlement.

65. One interesting development in the Chinsali District is worth noting. African farmers in this district have formed a committee to help each other and to acquire implements communally. This may later develop into a co-operative society.

Survey of Plateau Area of Serenje District.

66. The plateau area of Serenje District provides an interesting example of a traditional agricultural system already in an advanced state of decay, and of a land area which is overcrowded and in process of deterioration, although the mean population density is only about 7.3 persons per square mile.

67. The limitations and the inherent dangers of the system of land usage practised by the Serenje Lala were first recorded in the course of the Ecological Survey of the Territory (Report of the Ecological Survey. N.E. Rhodesia. Published, 1943.) Subsequently, detailed studies of similar systems were made in the Mkushi District, and in 1946 a survey of the plateau region of Serenje was carried out by Mr. D. U. Peters, Agricultural Officer, with the co-operation and assistance of the Anthropologists of the Rhodes-Livingstone Institute. The method of survey* employed was that which has been evolved over the last eight years largely in connection with the resettlement work, with the addition of a ring-count technique for ascertaining the age of tree growth and regrowth. Most fortunately a series of aerial photographs, taken in 1933, were available for part of the area. These were used to check the accuracy of the method of estimating the age of regrowth, and they also yielded other information of the greatest value. The report is summarised in the following paragraphs.

68. The survey data give an estimated carrying capacity for the Serenje Plateau and the Lala system of about 6 to 6.5 persons per square mile. The report, however, rightly stresses the conception of "marginal" and "unfavourable" land. In resettlement work the application of the theoretical estimate of land carrying capacity is valid because water supplies are provided where they are needed and a more or less "ideal" distribution of population is achieved by careful planning. With a natural distribution of population, however, the "marginal" and "unfavourable" land factors become important. When these are taken into consideration, the estimate of mean carrying capacity for the "haphazard" application of the Lala system is reduced to about four persons per square mile.

69. The available area of the Serenje Plateau (*i.e.*, the whole area less a game reserve of 172 square miles and Lake Lusiwashu) is some 5,763 square miles in extent, and the resident population as estimated by the survey is about 42,000. The general mean population density is, therefore, about 7.3 persons per square mile, varying from 11.0 to 5.6 in individual chieftaincies. In the 100 square miles surrounding Lake Lusiwashu the greatest concentration of population is reached, and here the density is probably about seventeen persons per square mile. It may seem incredible that with populations as sparse as these, land resources should be deteriorating at an alarming rate and that complete collapse of the present system of food production should be within measurable distance; nevertheless such is the case.

70. Finger millet, the staple crop of the Lala, is produced by the "small circle" *chitemene* method described in the Ecological Survey Report for North-Eastern Rhodesia and, in greater detail, in publications at present in the press. A large area of woodland is cut each year, the trees being as a rule felled at breast height, though individual trees are lopped if considered too hard to fell. Branchwood from the felled and lopped trees is stacked in small circles and a number of other traditional forms, and burned to make a seed bed on which the millet seed is broadcast. The diet is supplemented by a variety of crops grown in very small, but more varied and developed, subsidiary gardens which are hoe-cultivated.

71. The *chitemene* areas are used for one year only and are then, in theory, rested for the full period of woodland regeneration. Data obtained during the survey indicate that under average conditions on the Serenje Plateau a period of at least thirty-five years is required for full regeneration of the trees after cutting at breast height, but on the burned areas the trees are killed and a longer period is necessary to allow of regrowth from seedlings. Since the average "garden family" (of 6.1 persons in this case) requires approximately 12 acres of fully grown woodland each year, the total land requirement of the system is obviously exceedingly high and the carrying capacity is correspondingly low.

72. Once the population density exceeds the carrying capacity for the system, the period allowed for woodland regeneration must be reduced and a whole train of consequences follows. The position now is that nearly half the present area of woodland garden has been cut from trees of about eleven years' regeneration. One immediate and obvious result of such a great

*A description of this method with examples of its application is in the press.

reduction of the regeneration period is an increase in the area cut ; it has in fact been increased from about 12 to nearly 19 acres for the average " garden family ". Because of the smaller amount of brushwood available, the total burnt area is reduced from nearly ten per cent. to little more than four per cent. of the area cut. In addition, the whole character of the garden changes from the traditional pattern, because of reluctance to carry the brushwood any greater distance than is necessary when a plentiful supply is available, and this change reduces still further the area which is actually cropped. The cumulative effect of these changes is to bring about a progressive reduction in the supply of the main cereal. Repeated cutting of immature regrowth weakens and kills the trees, eliminates seed-bearers, and must ultimately (and within a relatively short time in some areas) lead to destruction of the woodland and the collapse of the system.

73. It is judged that the food position is not yet critical, largely owing to the high yields of finger millet, which was estimated to average over 2,000 lb. of grain per acre of burnt land in 1945. The families dependent on gardens cut from woodland of about eleven years' regeneration (almost half of the total area of *chitemene* gardens) do not appear to obtain a sufficient supply of finger millet ; but approximately twelve per cent. of the woodland garden area was cut from fully regenerated woodland and the families owning such gardens had a not inconsiderable surplus of the cereal. The remainder of the woodland garden area, intermediate in condition between these two extremes, yielded a sufficiency of millet or a surplus. It was found, however, that a considerable proportion of families (the sample data suggest that the figure may be about twenty per cent) have no woodland gardens at all and are dependent for their finger millet supply on those who have. These families consist almost entirely of manless households and households whose man was absent, sick or otherwise incapacitated at the time of garden cutting.

74. The general food position is briefly summarised by saying that, owing to the surplus provided by the older woodland, the finger millet gardens still provide about nine-tenths of the total grain requirements. Cassava and sorghum from the subsidiary gardens make up the deficiency. There is a marked inequality of production but a much nearer approach to equality of consumption and the population as a whole has a barely adequate supply of the staple foodstuff. The " normal surplus ", which is the safeguard of subsistence agriculture, has disappeared.

75. The report suggests immediate measures to arrest the otherwise inevitable approach of famine, and a scheme for long-range agricultural development. One great difficulty is the ever-present problem of the absent male. About forty-four per cent. of the total adult male population (representing about fifty-five per cent. of the able-bodied men) are at work outside the district at any one time. If African agriculture in this area is to be developed the return of a considerable proportion of the men is essential, yet their withdrawal from employment will have serious repercussions ; such is the fundamental contradiction in the present economy.

76. For a number of years efforts have been made by the Administration to encourage bean growing as a source of income in Serenje District, but apparently with no marked effect on the economy of the district or the number of absent males. At the time of the survey there were about 400 individuals growing beans for sale and their average production in 1945 was at most one bag per head. In addition a small surplus of other foodstuffs was sold, the total sales, including beans, amounting to 196 tons. The data indicate that two-thirds of the population made no sales, and those who did received an average return of about 10s. 1d. per family or 2s. 2d. per head.

77. In theory the solution of the Serenje problem is comparatively simple ; in practice it presents great difficulties. There is, in the first place, the reluctance of the men to remain at home even when a source of income is available. Secondly, the present system has a good many obvious advantages and will not be readily abandoned or easily changed. The system allows of the use of soils which would otherwise be uncultivable, it gives a reasonable certainty of good yields and it needs no capital but a small axe-blade. Above all, the labour requirement is low and discontinuous, and the maximum labour requirement (for garden preparation) is at the time of harvest and in the cooler weather, when food and energy are at their maximum. The limited burden which is put upon the men fits in well with the system of migrant labour ; indeed it is possible for a man to cut in a single season sufficient to ensure the food supply of his family for a couple of years. For these reasons, changes are unlikely to be willingly accepted until hunger has made the disadvantages of the system sufficiently obvious, and it is suggested that agricultural improvement work should begin in the area which is at present most seriously affected and should be extended gradually to the others.

78. One danger which would accompany a radical alteration of the present system is worth noting as an example of the extraneous factors which have to be considered when any modification of a system is contemplated. Although most of the Serenje Plateau is fly-free, very few cattle and small stock are owned by the people and it is most desirable that the number of stock should be increased to at least the equivalent of 84,000 head of cattle, the estimated minimum carrying capacity of the fly-free area. But this freedom from tsetse may very well be a result of the degeneration of woodland which the system has caused and, at present population densities, the abandonment of *chitemene* or any material reduction of it may lead to the encroachment of tsetse.

Introduction and Improvement of Native Food Crops.

79. Selection of kaffir-corn from local strains was continued at Kambowa Station in the Western Province with promising results. In addition to selection from Lamba types, kaffir-corns were collected from other parts of the country and dwarf strains were obtained from the United States of America in exchange for seed of local varieties. This work is necessarily slow. In an attempt to secure some immediate improvement a campaign to induce the people to do their own selection of kaffir-corn seed was carried out in the resettlement areas by African assistants trained for the purpose. It is hoped that this mass selection will ensure that the best of the crop is kept for seed. Trials of rice, with the object of finding a type suitable for relatively high altitudes, are being made in the Western Province, and include varieties from Nyasaland and collections from within the Territory. The "Pemba" strain again proved most satisfactory and gave an average yield on the station and on plots throughout the district of over 2,000 lb. per acre. Work at Kambowa includes also the introduction, testing and distribution of a considerable number of crops new to local native agriculture. These include wheat, taro, turmeric, ginger, lima bean, pineapple, and new selected varieties of sweet potato. Some of these introductions are already being distributed from the seed farms.

80. At Lunzuwa, the Northern Province Station, crop selection work is being carried out with finger millet (*Eleusine coracana*), kaffir-corn and cassava. The cassava collection was reduced to four varieties, C4, P7, K1 and Wallace, all others being discarded as susceptible to mosaic. Distributions from Lunzuwa and the Northern Province seed farms included cuttings of mosaic-resistant cassava, vines of the calabash sweet potato, English potatoes, seed of Hickory King maize, "90-day" yellow maize and beans. There is still no local demand for kaffir-corn seed and it is now proposed to try the biennial (sonkwe) types, which are said to be less attractive to birds. Some ground-nut seed was sent to Fort Rosebery to assist the ground-nut campaign among the Unga. Seed of rapidly maturing grain crops was sent to Luwingu for pre-rains planting in the Bangweulu Swamp area. The object is to obtain a crop on the moist land before the annual inundation begins. Some success appears to have been achieved with what is said to be a 90-day maize. This is being followed up.

81. In the Eastern Province a start has been made with crop improvement by establishing two seed farms at tribal centres and instituting work on maize selection.

82. The most important crops of the plateau region in the Southern Province are maize and cowpeas. Native types of maize have now been almost completely replaced by higher-yielding European varieties, but preliminary trials have indicated that the local cowpea is a poor yielder and that strains which give higher yields under local conditions will help to make the crop more popular as a rotation for maize. Collection and trials of varieties have been started at the Magoye Station, and some of the introduced types have already been distributed.

83. Distribution of fruit tree seeds and seedlings from Native Authority and departmental nurseries was continued in the Eastern and Western Provinces.

Agricultural Education.

84. School gardens, planned and supervised as far as possible by the Department, are still the main basis of practical agricultural education.

85. In the Southern Province, where such gardens have been in operation for a good many years, they have, perhaps, influenced agricultural practice more than any other method of approach, and their influence may be expected to increase as the pupils themselves become farmers. Until now, the implements, oxen and manure for the running of the gardens have been provided by the parents of the pupils, an arrangement which ensures that the parents take some interest and which works well enough so long as they are able and willing to make this contribution. For some years it has been evident that the success of departmental propaganda, to which the school gardens have largely contributed, was likely to prejudice their efficiency. In many areas manure, formerly wasted, is now regarded as so valuable that

parents are unwilling to spare any for the school gardens, while realisation of the need for early preparation and planting of their own gardens, and the Native Authority rule which prohibits late planting of maize, makes them unwilling to lend implements until too late in the season. The time has come when the school gardens in the Southern Province must be provided with their own stock and equipment, or they will cease to be the force for good which they have been in the past. This problem does not yet arise in the Northern, Eastern and Western Provinces, where the hoe and axe are still the main implements of agriculture, and the school gardens are hoe-cultivated.

86. In the Northern Province it was impossible to give adequate attention to school gardens owing to shortage of European staff. The province has now twenty-eight agricultural teachers, trained at the Senga Hill Training Centre, and the objective is to provide such a teacher, for each of the seventy Lower Middle Schools. In the earlier years close supervision is essential for the teachers appear to suffer from the common inability of the African to apply the basic information he has acquired to the solution of a particular problem, and they seem to find difficulty in adapting their training to the agriculture of the part of the province in which they happened to be stationed.

87. The great diversity of the agricultural systems of the Territory, and variations of agricultural practice even within districts, detracts from the value of centralised training of departmental staff. For this reason there is much to be said for the training of African recruits at the agricultural stations and in the field, the method which, in the absence of staff and facilities for centralised training, has so far been employed. Its main disadvantage is that the field staff cannot give adequate attention to training without prejudice to their other duties. Moreover, it will be impossible to adhere to the present system of informal and decentralised training if the output of African assistants required under the Development Plan is to be maintained. Provision for more centralised training and for the employment of a whole-time tutorial staff must therefore be made. It will be essential, however, that such training should be followed by practical instruction and experience in local problems.

88. Instructional visits by chiefs, councillors, headmen and villagers to agricultural stations, seed farms and school gardens were organised in every province where agricultural work is in progress. One party of chiefs and their councillors from the Northern Province joined in an agricultural excursion to Southern Tanganyika.

Experimental Work.

89. The difficulties of agricultural experimental work in this part of Africa, especially in native areas, have to be experienced to be fully appreciated. In addition to the normal troubles caused by soil and climatic variation, there is usually difficulty in finding enough land free from termitaria, and there is always the risk of theft and the depredations of monkeys, pig and other vermin. As the final exasperation, nature herself often seems reluctant to give an unequivocal answer even to the simplest of questions.

90. The bulk of the present experimental work is centred at the Katete and Petauke Stations in the Eastern Province, where an extensive and complex series of investigations into the working and cropping of local soils, under the conditions imposed by native agriculture, has been embarked upon. These investigations are mainly concerned with the improvement of native agriculture for people of very limited resources, in areas where manure from livestock is not available or is available only in small quantity. They are mostly long-term statistical experiments or observation blocks now only in their first or second crop year, and detailed discussion of them is as yet premature.

91. A large-scale trial of erosion control methods has been initiated in the Chingoma Valley in Fort Jameson District, on soils which are now over-worked and in process of erosion but which were once among the best in the district. The results of the first season appear to favour box-ridging (*i.e.*, cultivation ridges approximately on the contour, connected at intervals by similar ridges running up and down the slope) as the most efficient method of conservation. The sections protected in this way suffered little even from an exceptionally heavy storm, in comparison with areas under mounds or unboxed ridges. Unfortunately, the villagers concerned in the experiment have proved unco-operative and results for the 1946-47 season are likely to be masked by excessive weed growth due to poor cultivation—another example of the thorns which beset the path of the investigator.

92. On the experimental stations there are observation and demonstration trials of ridge cultivation and contour ridging, in comparison with cultivation on the flat and the traditional mound system of local agriculture. These are on newly broken land and, as might

be expected, have as yet produced no spectacular result beyond demonstrating that soils of unimpaired structure are resistant to erosion. At Petauke, however, in spite of a season of low rainfall, marked erosion occurred on some of the unprotected mound plots, and on these plots there was noticeable deterioration of soil structure by the end of the season. The Petauke plots gave an indication that, excluding the erosion factor, slightly higher yields are obtained from maize on mounds than on ridges of the standard size now in use, but in the Chingoma valley experiment survival of maize plants after an early drought was markedly better on the ridges than on the mounds.

93. The plough is now coming into use in parts of the Eastern Province and a parallel series of observations on ploughed plots has been started at Petauke.

94. It seems probable that soils structure is at least as important as chemical status in determining the fertility of soils, and experiments have been laid down to determine how far loss of fertility is due to actual removal of crops and to the effects of exposure and cultivation of the soils.

95. Long-term experiments include trials concerned with the maintenance of fertility by various methods of incorporating organic material in the soil, the effect on fertility of varying periods of cultivation and subsequent rest, the management of grass and bush fallows, and the relative merits of mixed cropping, traditional cropping practices and rotation. There are complementary experiments on compost making, time of application, effect on compost of exposure during the rains and the dry season, and on spacing and planting of crops.

96. In Petauke District, where White Burley tobacco has been introduced as a cash crop, various experiments with this crop are in progress. These include the effect of lime and kraal manure at varying rates of application, spacing of tobacco, variety trials and rotation trials to determine how best the crop can be incorporated into native agriculture.

97. Most of the land at Kambowa is still in use for food production, and experimental work, apart from crop introduction and selection, has been limited to trials of grasses and attempts to establish grass leys by seeding. Giant Rhodes grass has been successfully established from seed by using sunnhemp as a nurse crop. The sunnhemp was sown in lines across the contour four days before broadcasting the grass seed. A statistical field experiment to determine the effect of Giant Rhodes grass in maintaining fertility has been laid out and the initial plots planted. In addition to this work on the station, observation blocks have been established on the seed farms to illustrate the effects of manuring, spacing of crops, and the turning in (as opposed to burning) of weeds and crop refuse.

98. At Lunzuwa results were obtained from an experiment on the planting of cassava which was carried out at the request of the East African Agricultural Research Institute. These indicate that it makes no difference to yield whether cassava is planted on ridges or on the flat, or whether the cuttings are put in vertically or at an angle. As might be expected at an altitude of nearly 6,000 feet, yields were poor. A collection of twenty-six varieties of cassava, grown in observation plots at Lunzuwa, were lifted. Of these only two, a local selection and an introduction from Amani, yielded well enough to be worth further trial.

Native Export Crops.

(a) COTTON.

99. The department continued to handle the cotton production of the Marambo area of the Luangwa Valley at the request of the chiefs. The crop is, however, an unpopular one in present circumstances and, since it seems improbable that production will ever reach an economic level, there seems little point in continuing with it. There were 275 growers and the total weight of seed-cotton purchased was 43,000 lb.

(b) BURLEY TOBACCO.

100. In spite of a poor season which reduced yields, the Burley tobacco growing scheme near Minga made steady progress. The quality of the crop was remarkably good and reflects the improved skill of the growers. There were forty-six new participants and the total number of growers was 625. In the aggregate these planted 273 acres of tobacco and nearly 77,000 lb. of leaf were purchased from them at prices varying from 10*d.* to 1*d.* per lb. according to quality. The buying policy was again designed to place heavy emphasis on the importance of quality and there can now be no doubt as to its wisdom and efficacy. The average price paid (including an after-sales bonus) was 6.28 pence per lb. and the average receipt per grower was £3 4*s.* 1*d.*, the highest yet realised.

101. The crop was graded and packed departmentally and 70,500 lb. of packed leaf were eventually sold by auction at Fort Jameson for £6,344, an average of nearly 21.6 pence per lb. A profit of about £3,000 was made on the year's working. This has now been taken over by the newly formed Petauke Producers' Association, the executive committee of which consists of the District Commissioner, the Agricultural Officer and two representatives of the growers. It is hoped that the Association will shortly become a recognised Co-operative Society. If so, the society will be given the best of starts financially and in all other respects, thanks to the efforts of the growers themselves and to several years of patient departmental work.

Conclusion.

102. In my first Annual Report I wrote,—“The loyalty and industry of the departmental staff can so much be taken for granted that it is not proposed to pay the dubious compliment of acknowledging the obvious.” In this my last report perhaps some relaxation of the restraint exercised for so many years may be permissible. In the personnel under their direction few persons can have been so fortunate as I have been. None can have been served with greater loyalty and integrity. In saying “Good-bye and good luck” to all members of the Agricultural and Forestry Staffs, I am deeply conscious of a personal and permanent debt of gratitude to them.

MAZABUKA,
29th July, 1947.

C. J. LEWIN,
Director of Agriculture.